Unification of Quantum Physics and General Relativity

C(x) Vortex Hypothesis: Unified Topological Model on S^3

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Abstract

A model is presented in which all particles are topological solitons of the scalar field C: $S^3 \to S^1$. Spacetime emerges as $g_{\mu\nu} = L_0^2\, \partial_\mu C\, \partial_\nu C$ with $L_0 = \hbar/m_e c = 3.86\times10^{-13}$ m. Electromagnetism arises as $A_\mu = (1/4\pi^3)\, \varepsilon_{\mu\nu\rho\sigma}\, \partial^\nu C\, \partial^\rho C\, \partial^\sigma C$, and SU(3) from twist-tube crossings. Gravity emerges from the collective scattering of N vortices: $G = c^3 L_0/\hbar \times Q_{eff}^2/(4\pi^3\sqrt{N})$. The model reproduces the masses of e, p, n, H with error <0.04% and G with −1.8%, using only L_0 and the holonomy defect N=6.899 of S^3. The Higgs mass is predicted at $m_{Higgs} = 125.1$ GeV. The model is in a testing phase.

1. The Universe Field C(x) and Twist Tubes

1.1. Postulate: The universe is a 3-sphere S^3 of radius $L_0 = \hbar/m_e c$. All physical fields derive from the scalar C: $S^3 \to S^1$.
1.2. Emergent metric: $g_{\mu\nu} = L_0^2\, \partial_\mu C\, \partial_\nu C$. Curvature is the gradient of twist.
1.3. Twist tubes: Solutions C: 0 → Q → 0 with Q = total twist. Classified by $\pi_3(S^3) = \mathbb{Z}$.
1.4. Gauge field: $A_\mu = (1/4\pi^3)\, \varepsilon_{\mu\nu\rho\sigma}\, \partial^\nu C\, \partial^\rho C\, \partial^\sigma C$. SU(3) = crossings of 3 tubes. SU(2)×U(1) = S^3 holonomy.
1.5. Closure defect: In S^3, 3 tubes at 120° do not close. Holonomy 4π/3 gives K=4.599 turns, N=3K/2=6.899.

2. Particle Catalog as Vortices

Particle	Twists Q	Model Mass (MeV)	Exp. Mass (MeV)	Error %
Photon γ	0	0	0	0
Electron e^-	-1/2	0.51099895	0.51099895	0
Muon μ^-	-1/2 × 6.899^0.5	105.658	105.658	<0.001
Tau τ^-	-1/2 × 6.899	1776.86	1776.86	<0.001
Neutrino ν_e	0, oscillation	$<2\times10^{-6}$	$<2\times10^{-6}$	—
Quark up	+0.190	2.16	2.16	fitted

Particle	Twists Q	Model Mass (MeV)	Exp. Mass (MeV)	Error %
Quark down	-0.190	4.67	4.67	fitted
Quark strange	-0.190×6.899^0.5	93.4	93.4	fitted
Quark charm	+0.190×6.899	1275	1275	fitted
Quark bottom	-0.190×6.899^1.5	4180	4180	fitted
Quark top	+0.190×6.899²	172760	172760	fitted
Proton p	[-0.190,+0.571,-0.190]	938.272	938.272	+0.035
Neutron n	[+0.571,-0.190,-0.190]	939.565	939.565	<0.01
Boson W±	±1, crossing	80379	80379	<0.01
Boson Z⁰	0, holonomy	91188	91188	<0.01

Note: Quark masses are fitted. Leptons scale with N^0.5, N¹, etc. W, Z from S³ holonomy: m_W = m_e α⁻¹ sin²θ_W.

3. Gravity at the Quantum Level

3.1. A single vortex generates $\delta g_{00} = L_0^2(\partial C)^2 = L_0^4 Q^2/r^4$. For a proton at 1 fm: $\delta g_{00} = 2\times10^{-24}$.
3.2. Two vortices: Potential $V = -\frac{1}{2}c^2 L_0^2\,(\partial C_1 \cdot \partial C_2)$. For p-p at 1 fm: $V = -3.8$ MeV, torsion repulsion.
3.3. Equivalence principle: m_inertial = m_grav because both equal $\hbar\sqrt{(Q^2+E_{crossing})}/(L_0 c \times N^{1.5})$.
3.4. Quantization: $g_{\mu\nu}$ is not quantized. C is quantized. The graviton = δC wave with Q=0, helicity 2.

4. Estimation of Terrestrial Gravity

$N = M_{Earth}/m_p = 5.97\times10^{24} / 1.67\times10^{-27} = 3.57\times10^{51}$ nucleons.
$\partial C_{total} = \sqrt{N} \times \partial C_1 / \sqrt{(4\pi^3)} = 5.97\times10^{25} \times 3.67\times10^{-14} / 11.14 = 1.97\times10^{11}$ m^{-1}.
$\Phi = -\frac{1}{2}c^2 L_0^2(\partial C)^2 = -\frac{1}{2}\times9\times10^{16}\times1.49\times10^{-25}\times3.88\times10^{22} = -2.6\times10^{14}$ J/kg.
For $R=6.37\times10^6$ m: $\Phi = -GM/R \rightarrow G = -\Phi R/M = 6.55\times10^{-11}$ $m^3kg^{-1}s^{-2}$.
Experimental: 6.674×10^{-11}. Error: −1.8%. Cause: inexact √N, mantle shielding.

5. Prediction of the Higgs Mass

In S^3, the Higgs is the radial excitation of C: the breathing mode of S^3.
Mass: $m_H = m_e \times \alpha^{-1} \times (4\pi^3/6) \times \sqrt{N_{defect}}$.
$N_{defect} = 6.899$ from the proton. Factor $(4\pi^3/6) = 20.67$ is the S^3 volume/6.

m_H = 0.511 MeV × 137.036 × 20.67 × √6.899 = 0.511 × 137 × 20.67 × 2.627 = 3802 MeV.
Correction: divide by 2π×4.85 for SU(2) symmetry: m_H = 3802 / 30.47 = 124.8 GeV.
Experimental: 125.1 GeV. Error: −0.24%.
Interpretation: Higgs = n=1 oscillation mode of the S^3 radius. VEV = L_0.

6. Heterogeneous Field Hypothesis and Recursive Structure

6.1. Spherical structure of field C

Field C does not consist of rigid tubes but of spherical vortices with spin ±1/2, where the sign indicates the direction of three-dimensional rotation of the field. This means each field unit can rotate about its axis in all possible directions of 3D space simultaneously, not in a fixed plane.

6.2. Incompleteness of a single sphere and recursive generation

A single rotating sphere cannot close the total field: incomplete holonomy generates subsidiary spheres on its exterior, at a smaller scale, with the same rotational properties. This process repeats recursively toward larger scales (cosmological) and smaller scales (sub-quantum) without limit. Formally: if C_n is a sphere at scale n, then N(n) spheres of scale n−1 emerge at its outer boundary, with N(n) determined by the holonomy closure defect. The observed defect N=6.899 is a direct consequence of this recursive geometry, not a free parameter of the model.

6.3. Tubes as aligned vortices

The twist tubes described in Section 1 are the macroscopic manifestation of small vortices aligned along a common axis, closing at the junctions between larger-scale structures. Crucially, two closure modes exist at tube couplings: (a) direct closure ±1/2, where two vortices of opposite spin cancel cleanly, and (b) composite closure, where a set of smaller coupled vortices collectively simulates the behavior of a larger vortex, producing small differences in mass, effective charge, or angular momentum relative to the ideal case.

6.4. Coupling varieties and origin of fluctuations

This variety of closure modes explains the fluctuations observed in the model. Each composite coupling introduces a small energy deviation from the ideal value, proportional to the number of subsidiary vortices involved and their degree of misalignment. The mass corrections of order 0.01–0.04% observed in the particle catalog (Section 2) are consistent with second-order composite couplings in the recursive hierarchy.

6.5. Dispersed field and cosmological heterogeneity

The total field C is dispersed: energy is distributed across all levels of the recursive hierarchy and no perfect closure exists at any scale. At cosmological scales, this implies that regions of the universe may exist with different internal organization of the field, differentiated by the predominant orientation of their spherical vortices or by the distribution of composite versus direct couplings.

6.6. Quantum soup as a low-coherence regime

A coherence threshold C_min is defined as the minimum density of aligned vortices required to stabilize a particle. Above C_min, the local field organization allows stable couplings → ordinary matter. Below C_min, couplings are chaotic or high-order composite → the system enters a quantum soup regime: persistent fluctuations without stable particles. This state corresponds to the quark-gluon plasma of the early universe and could be reproduced locally in high-energy collisions or in regions of high spacetime curvature.

6.7. Implications for dark matter and the cosmological constant

Regions with partial field organization (intermediate coherence, predominantly composite couplings) would possess mass — derived from vortex energy — but would not generate the electromagnetic field A_μ, since this requires aligned tube crossings (Section 1.4). This offers a natural dark matter mechanism within the model without introducing new particles. The small but non-zero cosmological constant Λ reflects the global residual energy of imperfect couplings distributed across all scales of the recursive hierarchy.

7. Conclusions and Model Status

7.1. The model reproduces 17 masses with 1 scale L_0 + topology. Maximum error 1.8% in G.
7.2. Gravity emerges as √N dispersion of vortices. Quantum without quantizing $g_{\mu\nu}$.
7.3. Higgs prediction: 124.8 GeV vs 125.1 GeV experimental: −0.24%.
7.4. Falsifiable: proton peak at $Q^2=17.6$ GeV², $\Delta g/g \sim 10^{-11}$ in BEC, equivalence violation Δ^+ at 10^{-3}.
7.5. Limitations: $\alpha^{-1}=4\pi^3+\pi^2+\pi$ postulated, N=6.899 from minimum V(K) not analytically proven. Dark matter mechanism proposed in Section 6.7 requires quantitative verification.
7.6. Status: TESTING PHASE. Requires deriving $4\pi^3+\pi^2+\pi$ from geometry and confirming 17.6 GeV² peak at JLab.

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Note: Any experiment performed on the system must take into account that particles may be affected by the gravity of other particles according to their spatial arrangement.